UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,816	07/11/2003	Linyong Pang	NTI-703-1P1P	5976

29477 7590 05/17/2005

BEVER HOFFMAN & HARMS, LLP
1432 CONCANNON BLVD
BLDG G
LIVERMORE, CA 94550-6006

EXAMINER	
SIEK, VUTHE	

ART UNIT	PAPER NUMBER
2825	

DATE MAILED: 05/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/618,816	PANG ET AL.	
	Examiner	Art Unit	
	Vuthe Siek	2825	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-60* is/are pending in the application.

4a) Of the above claim(s) *50-60* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-49* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-60* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/11/03;1/25/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to application 10/618,816 filed on 7/11/2003. Claims 1-60 remain pending in the application.

Priority

2. Current status of all related applications on first page of the specification should be updated. Filing date of 09/154,397 should be --September 16, 1998--, instead of August 7, 1998. This problem should be corrected in application data sheet.

Election/Restriction

3. Restriction to one of the following inventions is required under 35 U.S.C. § 121:

I. Claims 1-49, drawn to a method/system/computer program product for analyzing a mask for use in photolithography, classified in Class 716, subclass 21.

II. Claims 50-60, drawn to a graphic user interface (GUI) for defect printability analysis on a photolithographic mask, classified in Class 716, subclass 21.

1. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another and materially other than GUI or by hand.

Because these inventions are distinct for the reasons given above restriction for examination purposes as indicated is proper.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

5. During a telephone conversation with Ms. Jeanette Harms (35,537) on 5/5/05 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-49. Affirmation of this election must be made by applicant in replying to this Office action. Claims 50-60 are withdrawn from consideration and Examiner is requested to cancel Claims 50-60 as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 4, 6-10, 13-14, 22-23, 25, 27-28, 29-30, 31, 34-35, 43, 45-46 and 48 are rejected under 35 U.S.C. 102(e) as being anticipated by Sonderman et al. (6,802,045).

8. As to claims 1, 23 and 43, Sonderman et al. teach a method/system/computer program product for analyzing a mask for use in photolithography (Fig. 1-9). The system comprising interaction between processing control environment, simulation environment and manufacturing/processing environment (Fig. 1-2). The processing tools (steppers, scanners, step-and-scan tools, etch process tools, photolithography process tools and the like, col. 4, lines 25-31) process semiconductor wafers (wafers must include mask file) using a plurality of control input signals and manufacturing parameters. The integration of the simulation environment and the process control environment into manufacturing/processing environment facilitates more accurate control of the processing of semiconductor wafers. The simulation environment provides a feedback modification of the control parameters invoked by the processing control environment, where the manufacturing/processing environment can send metrology data results (analyzed data results) to simulation environment to perform further various tests and calculations to provide more accurate, modified control parameters to the process control environment. A feedback loop in then completed when the process control environment sends the modified or adjusted process control parameters to the manufacturing/processing environment for further processing of semiconductor wafers. The simulation environment receives device physics model, process model, and equipment model, where changes to compensate for errors (mask defects) detected by the simulator can be made to any one of the models and control parameters adjustment can be produced (Fig. 3). The system and method comprise define process tasks (jobs) (col. 6, lines 14-47). Thus, the integration of simulation

environment and process control environment into the manufacturing/processing environment facilitates more accurate control of semiconductor wafers allowing for testing various manufacturing factors in order to study and evaluate the interaction between the manufacturing factors that prompts the process control environment to invoke more accurate process control to thereby providing uniformly semiconductor wafers (output results of the job (photolithography process) including printability results for the defects on the mask) (description of Fig. 5).

9. As to claims 4, 6, 8, 25, 27, 29 and 45, Sonderman et al. teach the parameters including settings relating to the mask (Fig. 9, process recipe settings based on a plurality of processing tools as described above); the parameters include settings relating to an inspection system that provided information for the mask file (col. 7, lines 54-65, wafers must include mask file); the parameters include settings relating to a stepper that can be used in exposing the mask during photolithography (col. 7, lines 54-65, col. 6, lines 14-47, col. 4, lines 25-31; col. 3, lines 50-63).

10. As to claim 9 and 30, Sonderman et al. the processing tools include photolithography process as described above, therefore in order to make appropriate changes to manufacturing control parameters to affect the operations of the manufacturing/processing environment, at least one of wavelength, numerical aperture, reduction, defocus and illumination must be adjusted in order to provide more accurate process control (col. 7, lines 54-65, col. 6, lines 14-47, col. 4, lines 25-31; col. 3, lines 50-63).

11. As to claims 10 and 46, Sonderman et al. a plurality of manufacturing/processing tools (Fig. 1). In order to perform a process task or job, the system Fig. 1 must include a job manager to distribute multiple jobs or tasks to be processed (jobs running by different processing tools A and B as shown in Fig. 1).

12. As to claims 13, 34 and 48, Sonderman et al. teach performing multiple simulations to produce output results of course for user review (because of a feedback loop, col. 5, lines 1-9), where one level includes overall summary of simulations performed on the defects (detected errors by simulator, col. 6, lines 14-34).

13. As to claim 22, Sonderman et al. teach the system is implemented in an Advanced Process Control (APC) Frame-work allowing for remote access and monitoring of the process performance (Col. 9, lines 58-67). This suggests accessing the results of the job (task process) using a web browser.

14. As to claim 31, Sonderman et al. teach manufacturing parameters, control input parameters where the parameters can be modified and adjusted using simulation data results through a feedback loop between interaction between in order to provide accurate a process task to thereby providing uniform semiconductor device (col. 4, lines 10-47).

15. As to claim 7 and 28, Sonderman et al. teach manufacturing model to define a process script and input control parameters that implement a particular manufacturing process task or job (Fig. 1; col. 4, lines 18-63) (inspection system model).

16. As to claims 14 and 35, Sonderman et al. teach when performing a process task (job), the system 100 performs a process simulation function. Once the system 100

performs the process simulation function, the system performs interfacing function, which facilitates interfacing of simulation data (simulation results or overall summary of simulations performed on the defects) with the process control environment. The process control environment can utilize the simulation data in order to modify or define manufacturing control parameters that control the actual processing steps performed by the system. Once the system interfaces the simulation data with the process control environment, the system then performs a manufacturing process based upon the manufacturing parameters defined by the process control environment (col. 6).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. Claims 11-12, 20-21, 32-33, 40, 47 and 49 are rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045).

19. As to claims 11-12, 32-33 and 47, Sonderman et al. a plurality of manufacturing/processing tools (Fig. 1). In order to perform a process task or job, the system Fig. 1 must include a job manager to distribute multiple jobs or tasks to be processed (jobs running by different processing tools A and B as shown in Fig. 1). It is noticed that parallel processing is well known in the art. Therefore, it would have

obvious to one of ordinary skill in the art at the time the invention was made to performing multiple jobs processes by the processing tools as taught by Sonderman et al. in parallel this would be cost effective.

20. As to claims 20-21, 40 and 49, Sonderman et al. teach a method and apparatus for incorporating control simulation environment into a manufacturing environment by providing a process task (job) through processing tools (photolithography/steppers) (Fig. 1). Many times, semiconductor devices are stepped through multiple manufacturing process tools resulting in an output of non-uniform semiconductor devices. Sonderman et al. suggest that attempts to overcome wafer errors (mask defect) during manufacturing can be adversely affected by modifications made during one aspect of manufacturing that causes errors on another aspect of manufacturing. Sonderman et al. teach performing a simulation function and integrating the simulation function with a process control environment and a manufacturing environment (Fig. 1, col. 3 line 37 to col. 4, line 47). Sonderman et al. teach an interaction between a process control environment, a manufacturing/processing environment and a simulation environment is described in Fig. 1-2. Because the interaction facilitates more accurate control of the processing of semiconductor wafers and provide uniform semiconductor devices, it would have been obvious to one of ordinary skill in the art that the method as taught by Sonderman would have included entering a status for each defect based on a user's review of the results of the job (task) and providing a history of statuses for each defect.

21. Claim 15 is rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045) in view of Pack et al. (US 2004/0133369 A1) or Bruce et al. (US 2003/0161525 A1).

22. As to claim 15, Sonderman et al. teach when performing a process task (job), the system 100 performs a process simulation function. Once the system 100 performs the process simulation function, the system performs interfacing function, which facilitates interfacing of simulation data (simulation results or overall summary of simulations performed on the defects) with the process control environment. The process control environment can utilize the simulation data in order to modify or define manufacturing control parameters that control the actual processing steps performed by the system. Once the system interfaces the simulation data with the process control environment, the system then performs a manufacturing process based upon the manufacturing parameters defined by the process control environment (col. 6). Sonderman et al. do not explicitly teach defect scoring of the defects on the mask. Pack et al. teach that limitation (0026, 0169). Also Bruce et al. teach that limitation (0027). Since, simulation results are used to modify and adjust the parameters, it would have been obvious to one of ordinary skill in the art that simulation results (simulation summary) would have included defect scoring of the defects in order to facilitate more accurate control of the processing of semiconductor wafers to thereby providing uniform semiconductor devices as expected (col. 4, lines 18-63 of Sonderman) because severity of defect (scoring defect) are automatically classified as "pass" or "fail" by the inspection tool based on the defect type and size type to thereby providing operator to review.

23. Claims 2-5, 19, 24-26, 39, 41-42 and 44-45 are rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045) in view of Avant!...Solutions & Products (Avant!), "Taurus-Lithography, 2/22/01, pp. 1-3. or www.sematech.org/resources/litho/meetings/mask/200107/O_DATA-FORMAT-BO3.PDF (Sematech), "Mask Data Format Standardization, 7/11/01, pages. 1-13.

24. As to claims 2-3, 24 and 44, Sonderman et al. does not teach mask file includes a standard mask format file (MFF) or converting mask data into the standard MFF. Avant! or Sematech teach using standard mask data format where file size is reduced providing following advantages of processing times, computer and network infrastructure costs, data archiving, data transfer to mask shop and mask lithography write time (page 8). Therefore, because of expecting numerous advantages as described above, it would have obvious to one of ordinary skill in the art at the time the invention was made to utilize the standard mask format file (MFF) or converting mask data into the standard MFF in Sonderman's lithographical process.

25. As to claims 19 and 39, Avant! teach with Taurus-Lithography, one can analyze the printability of any very large region of an IC by simulating its aerial image and comparing it to the original mask design in order to improve the printability characteristics by using an optimization algorithm and a selection of models to calculate the printed contour (page 1).

26. As to claims 4-5, 25-26 and 45, Avant' teach settings including at least one of stepper, mask type, phase of the mask, and transmission of the mask (pages 1-3).

27. As to claims 41-42, Sonderman et al. teach an apparatus for incorporating control simulation environment into manufacturing environment for controlling a manufacturing process of a semiconductor device in order to provide uniform semiconductor device. Sonderman et al. a plurality of manufacturing/processing tools that interact with simulation environment and process control environment in order to facilitate more accurate control of the processing of semiconductor wafers (Fig. 1). In order to perform a process task or job, the system Fig. 1 must include a job manager to distribute multiple jobs or tasks to be processed (jobs running by different processing tools A and B as shown in Fig. 1). This suggests that the apparatus as taught by Sonderman includes a graphical user interface. Sonderman et al. teach the APC framework also allows for remote access and monitoring of the process performance (col. 9, lines 58-67). This suggests the apparatus is operating with a web brower to provide the graphical user interface. In addition, Avant! also teach that graphical user interfaces (page 3), where they provide intuitive setup of stepper and mask characteristics, simulation control, selection of post-processing utilities, ability to save a simulation run and load saved result, setup of complete photoresistant processing recipes and parameters and powerful multi-dimensional capabilities for data extraction and visualization.

28. Claims 16-18, 36-38 and 41 are rejected under 35 U.S.C. 103(a) as being obvious over Sonderman et al. (6,802,045) in view of Potucek et al. (6,498,867).

29. As to claims 16 and 36, Sonderman et al. do not teach defect map. Potucek et al. teach that the data processing system can be set up automatically process captured

image data through a digital image and defect map and then to correct the defects using the defect map and digital image (Fig. 3, 7, col. 5, lines 48-57). Integrating the defect map as taught by Potucek into the system of Sonderman would be obvious to one of ordinary skill in the art at the time the invention was made the claimed invention in order to correct the mask defects as expected (col. 5, lines 48-57).

30. As to claims 17 and 37, Sonderman et al. do not teach color-coded based on a defect severity. Potucek et al. teach using color-coded based on a defect severity (first defect, second defect) (col. 3, lines 53-59, col. 5, lines 48-57, col. 6 line 16 to col. 7 line 42, col. 8 lines 23-39).

31. As to claims 18 and 38, Potucek et al. teach using color-coded based on a defect severity (col. 3, lines 53-59, col. 5, lines 48-57, col. 6 line 16 to col. 7 line 42, col. 8 lines 23-39). In order to grab attention to a user, one of ordinary skill in the art at the time the invention was made to indicate a high defect severity with a flashing light to thereby perform mask correction as necessary.

32. As to claim 41, Potucek et al. teach the system including output device for display defects (Fig. 2). This suggests that the system includes a graphical user interface.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Vuthe Siek whose telephone number is (571) 272-1906. The examiner can normally be reached on Increase Flextime.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Vuthe Siek

VUTHE SIEK
PRIMARY EXAMINER